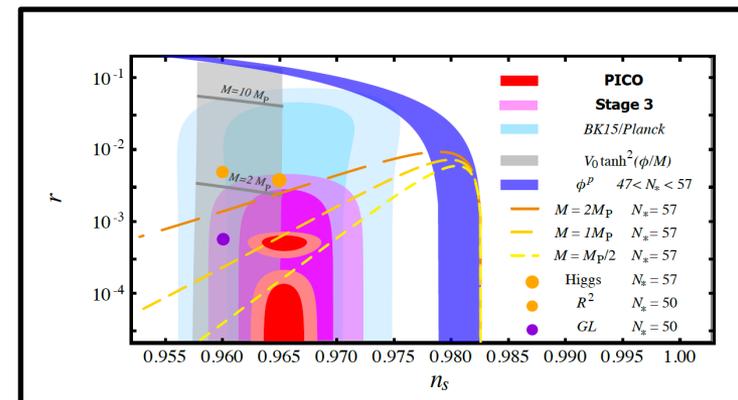
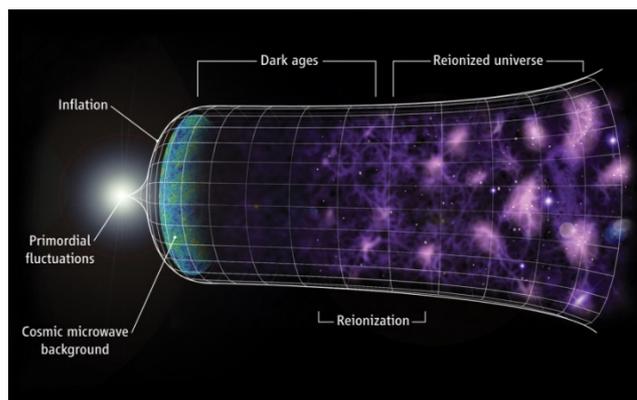
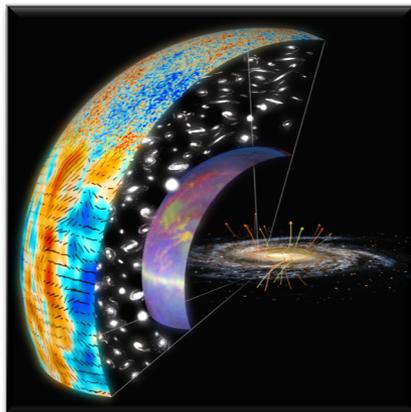


Inflation Probe Science Interest Group Update

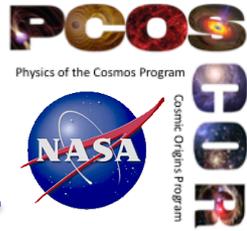


Graça Rocha

Jet Propulsion Laboratory/Caltech
 Chair, Physics of the Cosmos Program Analysis Group, PhysPAG
 Co-Chair, Inflation Probe Science Interest group, IP SIG

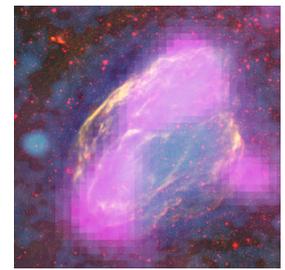
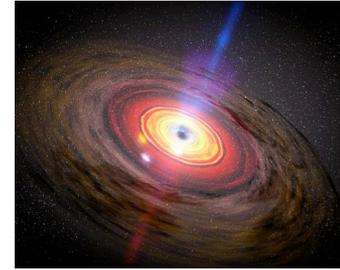
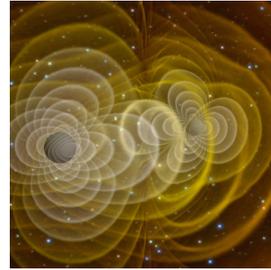
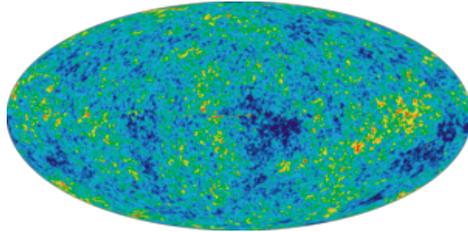
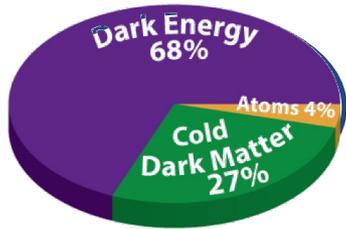
graca.m.rocha@jpl.nasa.gov; graca@caltech.edu

Outline



- Introduction to **PCOS**, **PhysPAG** and **IPSIG** (reminder)
- **IPSIG Highlights, Activities and Goals**

Physics of the Cosmos Science Objectives



- Increase our knowledge of dark energy
- Precisely measure cosmological parameters governing evolution of the universe and test inflation hypothesis of Big Bang
- Test validity of Einstein's General Theory of Relativity and investigate nature of spacetime
- Understand formation and growth of massive black holes and their role in evolution of galaxies
- Explore behavior of matter and energy in its most extreme environments



Activities supporting PCOS goals and priorities:

- Managed by the PCOS/COR Program Office at NASA's Goddard Space Flight Center and reported to NASA Headquarters.
- Include:
 - **Mission studies** and pre-project mission oversight, insight, and support
 - **Strategic technology (SAT)** maturation oversight, insight, and support
 - **Community engagement**, including via the Physics of the Cosmos Program Analysis Group (PhysPAG)
 - Maintaining **science cognizance** to enable more successful NASA strategic planning

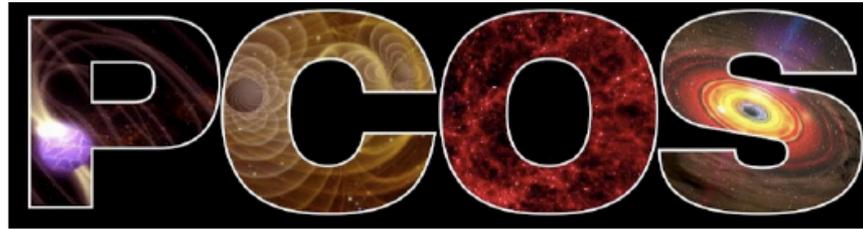
The PCOS Program Office hosts

- Athena Study Office
- LISA Study Office

and oversees

- science and
- technology activities

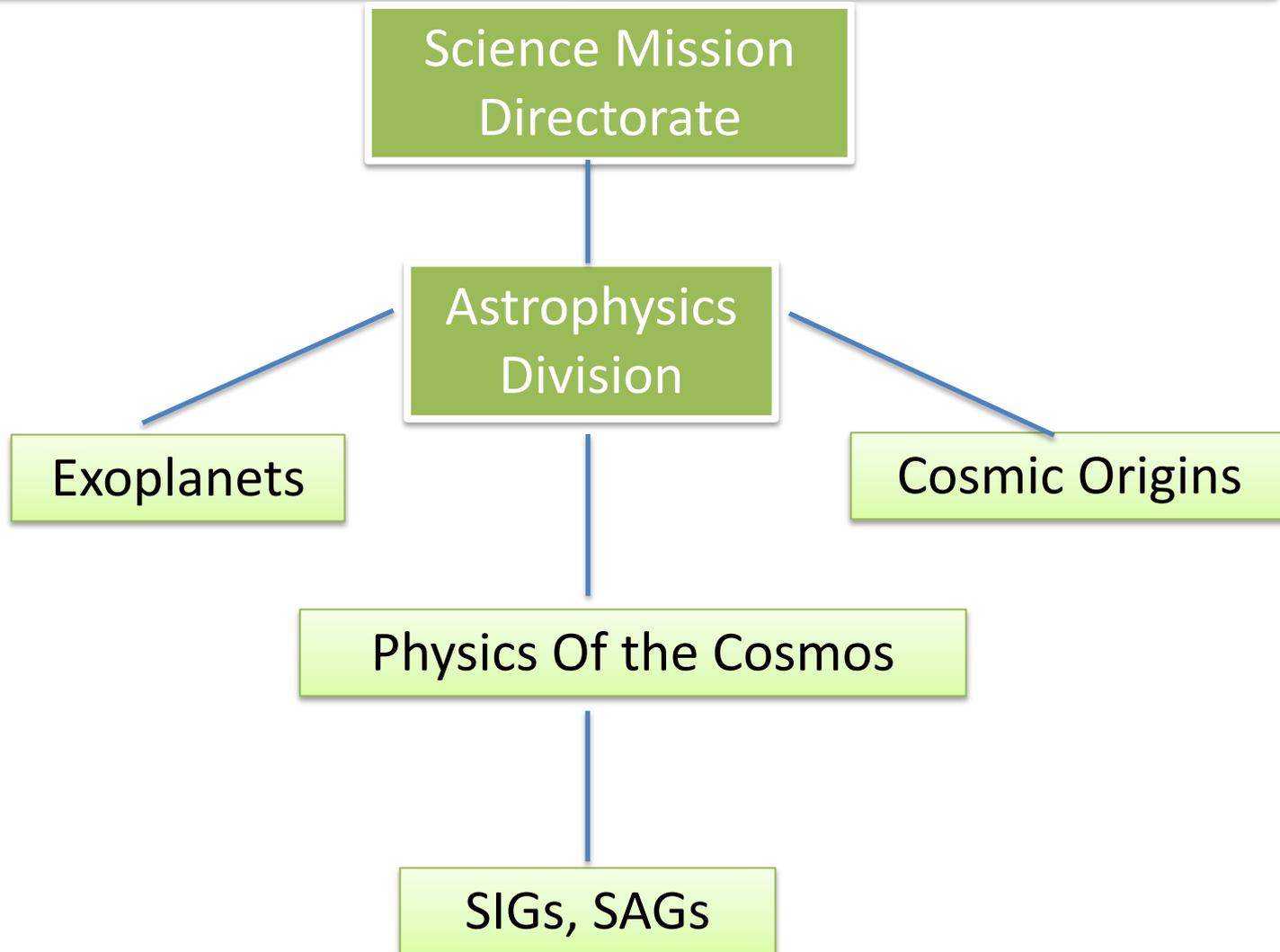
for NASA's contribution to these ESA-led and other strategic missions.



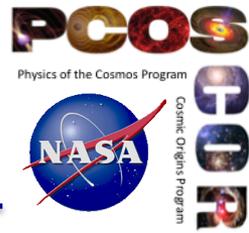
PCOS Chief Scientist enables ground-breaking science from space by working at the interfaces between missions and studies, technology, the community, and NASA HQ.

Current PCOS Science Goals and Priorities:

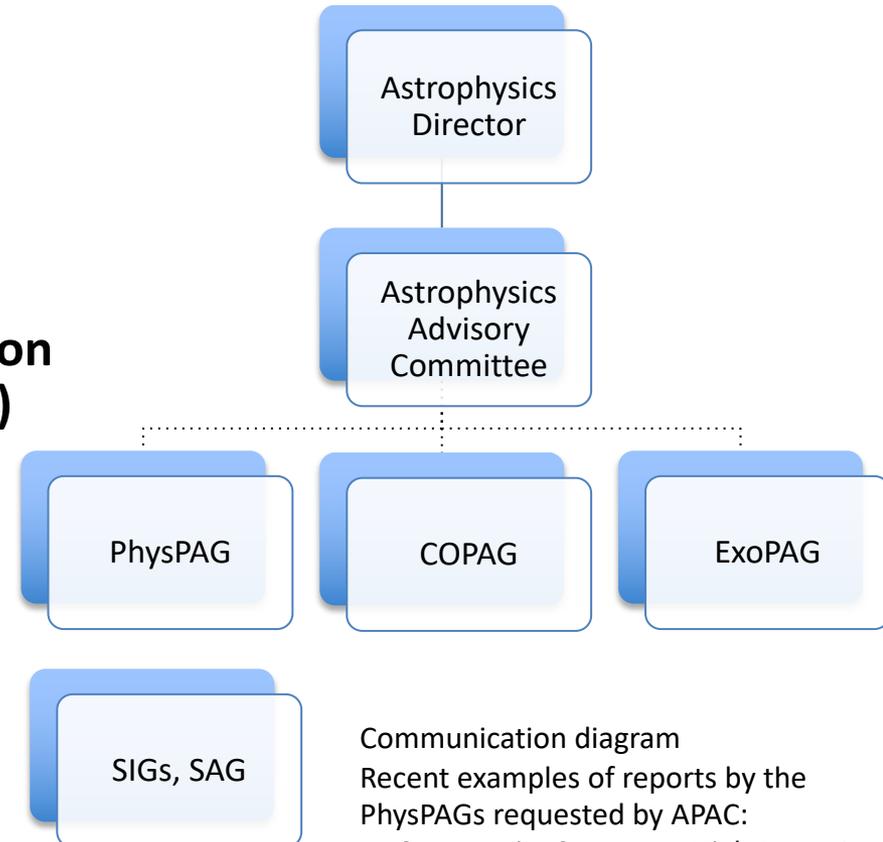
- Ensure a more successful **Decadal survey** by supporting community preparations and HQ activities, spanning the range of inputs: from science to missions, technology, and state of the profession, which all impact our ability to do ground-breaking science
- Ensure more **successful missions** by
 - supporting on-going mission studies and pre-projects, eg LISA, Lynx, Athena;
 - through technology efforts, eg SAT;
 - by coordinating with current missions; and
 - by preparing for studies for mission recommended by the Astro2020 Decadal
- **Engage the community** to support a successful APD portfolio.



Communicating with NASA Astrophysics via the Program Analysis Groups (PAGs)



- The Physics of the Cosmos Program Analysis Group (**PhysPAG**) coordinates input and analysis from the scientific community in support of the PCOS program objectives.
- Study Analysis Groups (**SAGs**) **conduct specific analyses. PCOS just closed a SAG on Multi Messenger Astrophysics (MMASAG)**
- Science Interest Groups (SIGs) are longer-standing discipline fora.
 - IP SIG
 - GW SIG
 - XR SIG
 - GR SIG
 - CR SIG
 - CoS SIG

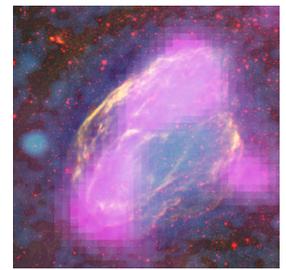
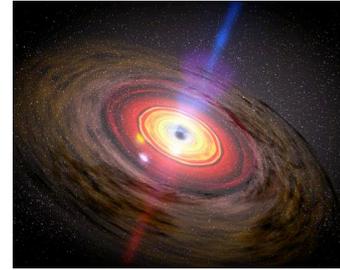
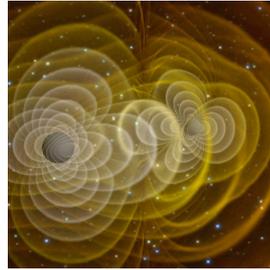
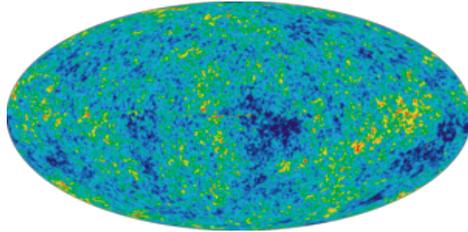
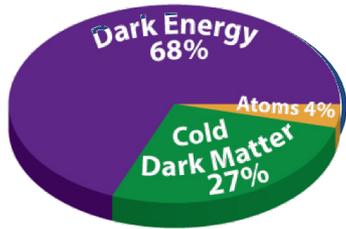
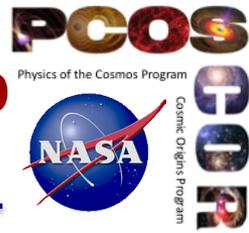


Communication diagram

Recent examples of reports by the PhysPAGs requested by APAC:

- Community Survey on High-Impact Research Science
- Community Survey on Possible Delay in 2020 Decadal Survey

Physics of the Cosmos Program Analysis Group



□ Six Science Interest Groups (SIGs)

- Cosmic Ray (CR SIG)
- Cosmic Structure (CoS SIG)
- Gamma-ray (GR SIG)
- Gravitational Wave (GW SIG)
- **Inflation Probe (IP SIG)**
- X-ray (XR SIG)

Want go get involved?

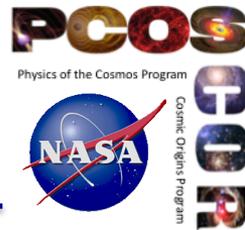
Go to:

<https://pcos.gsfc.nasa.gov/phypag/sigs-sags.php>

and subscribe to the relevant SIG emailing list

Annual call again this fall!

PhysPAG EC Membership



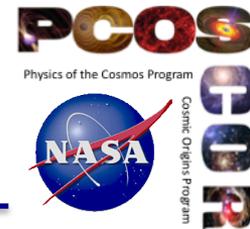
Name	Affiliation	Area of Expertise	Term Ends
John Conklin (Chair Emeritus)	Univ. of Florida	GW SIG	Dec 2020
Graça Rocha (Chair)	JPL/Caltech	IP SIG/CoS SIG	Dec 2020
Sylvain Guiriec	George Washington Univ.	GR SIG	Dec 2020
Kevin Huffenberger	Florida State Univ.	CoS SIG/IP SIG	Dec 2020
James Rhoads	GSFC	CoS SIG	Dec 2020
Abigail Vieregg	Univ. of Chicago	IP SIG / CR SIG	Dec 2020
Nicolas Yunes	Montana State Univ.	GW SIG	Dec 2020
Ryan Hickox (Vice Chair)	Dartmouth College	XR SIG	Dec 2021
Marcos Santander	Univ. of Alabama	CR SIG	Dec 2021
Jillian Bellovary	Queensborough Comm Coll.	GW SIG / XR SIG	Dec 2022
Sean McWilliams	WVU	GW SIG	Dec 2022
Bindu Rani	SURA, GSFC	GR SIG	Dec 2022
Grant Tremblay	SAO	XR SIG	Dec 2022

*New Roles

*In bold Co-chairs of IPSIG

*New members as of January 2020

IPSIG - Inflation Probe Science Interest Group



<https://pcos.gsfc.nasa.gov/signs/ipsig.php>

Goal: to provide quantitative metrics and assessment to NASA in regard to a future Inflation Probe mission. Specifically:

- Review and update mission science goals following current developments in the field (e.g., **Planck**, **sub-orbital** measurements),
- Review and update information about and requirements on potential foreground contaminants and their removal,
- Review and update requirements on and developments in control of systematic errors,
- Assess necessary technology developments and prioritize areas for increased technical emphasis.
- Organize mini-symposia at the AAS and APS meetings to present updates of IPSIG related activities and participating in relevant meetings (as is the case here)
- Facilitate community organization of white papers and Decadal Survey inputs (eg **PICO**, **CMB-S4**..)

The IPSIG is open to all members of the community. If you are interested in contributing to the work of the IPSIG, please subscribe using the webpage above. For other inquiries, e-mail **Co-Chairs**.

Kevin Huffenberger

khuffenberger@fsu.edu

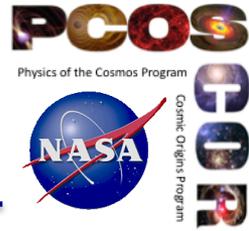
Graça Rocha

graca.m.rocha@jpl.nasa.gov

Abigail Viereg

avieregg@kipc.uchicago.edu

the Inflation Probe Science Interest Group highlights and updates

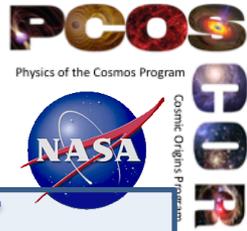


□ IP SIG

- Main activity of community was production of ~ **20 Science whitepapers** and **8 APC whitepapers** for Astro2020 decadal.
- For information on the SWP please take a look at the IP SIG webpage

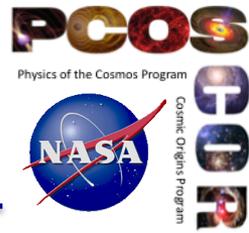
IPSIG – Science White Papers

<https://zzz.physics.umn.edu/decadal2020/doku.php?id=start>



- Primordial Gravitational Waves and Inflation
- Light Relics (Neff, BBN Abundances)
- Neutrino mass
- Dark Matter (focus: CMB/21-cm probes of DM interactions)
- Dark Energy and Modified Gravity
- BBN
- Primordial Non-Gaussianity
- Reionization
- Galaxy Cluster Feedback & Thermodynamics
- CIB and Star Formation
- Cluster Cosmology
- Galaxy clustering & growth of structure [Legacy Catalogs]
- Extragalactic radio sources
- Polarization of extragalactic sources
- Galactic Science
- Mapping Dark Matter on Small Scales with ultra-deep, high-resolution CMB measurements
- CMB Summary
- Summary of non-CMB Science from CMB Surveys
- Gravitational Probes of Ultralight Axion Dark Matter

the Inflation Probe Science Interest Group highlights and updates



□ IP SIG

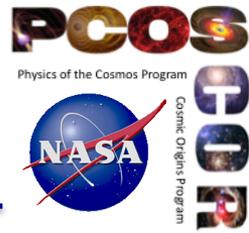
- Main activity of community was production of ~ **20 Science whitepapers** and **8 APC whitepapers** for Astro2020 decadal.

- **APC whitepapers:**

- 3 related explicitly to space-based projects: **PICO**, **LiteBIRD**, and description of a program for **CMB spectral distortions**
- Others related to technological development or ground-based projects (Ground-based efforts highly complementary to space based efforts)
- 1 paper, “The need of better tools to design future CMB experiments”, has a sub-section dedicated to space vs ground complementarity

- For information on the SWP please take a look at the IP SIG webpage

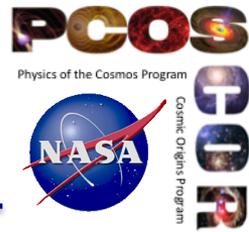
the Inflation Probe Science Interest Group highlights and updates



☐ IP SIG

- Organized (this) session at April APS 2020 - Virtual Meeting
 - IPSIG Update (this talk)
 - PICO (Probe of Inflation and Cosmic Origins) update - [Shaul Hanany](#)
 - Complementarity of Space and Ground-Based CMB Experiments – [Al Kogut](#)
 - Interplay of Foregrounds and Systematics: The Case for Low -Frequency Observations – [Krzysztof Gorski](#)
 - Data Analysis - Do We Have All The Necessary Tools? – [Reijo Keskitalo](#)
- **Current goals**
 - Continue organizing sessions and engage the community
 - Prepare for Decadal outcomes

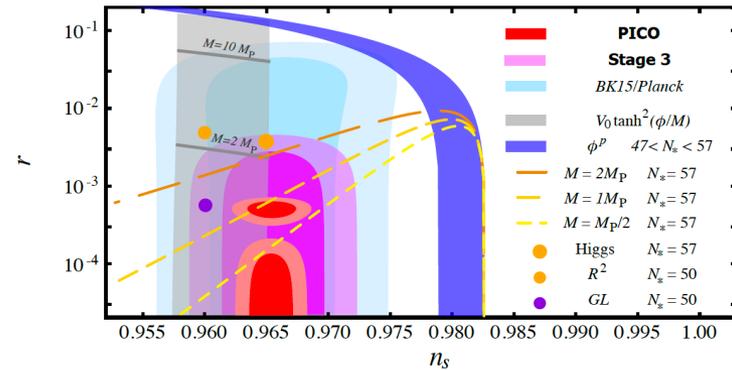
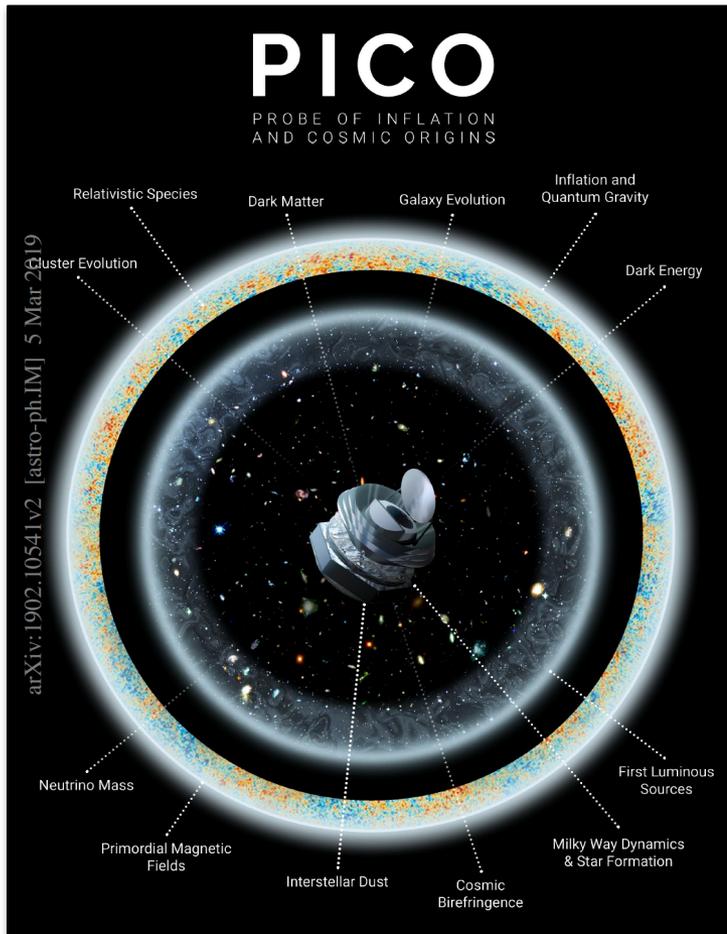
the Inflation Probe Science Interest Group highlights and updates



It's a exciting time for Inflation-probe science

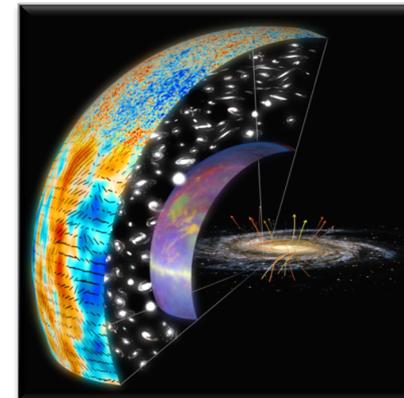
Final report delivered to NASA and Astro2020

PICO APC paper



KISS study: Designing future CMB experiments

<https://www.kiss.caltech.edu/workshops/fCMB/fCMB.html>



Several
APC papers

PhysPAG/SIG Meetings and Activities

- Winter AAS meeting, January 2020, Honolulu
- **April APS, April 2020, Washington, DC - Virtual Meeting**
 - PCOS/PhysPAG session
 - **IP SIG session (this session)**
 - XR SIG session tomorrow 6:30 pm – 8:00 pm (ET)
 - GW SIG and GR SIG cancelled due to COVID-19 pandemic

https://pcos.gsfc.nasa.gov/physpag/meetings/APS_2020/APS2020-agenda.php
- **AAS HEAD, September 2020**
 - Planning begun, likely including X-Ray and Gamma-Ray SIG sessions
 - Let us know if you'd like to see something in particular!